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A Comparison of the Technical Communications Practices of Russian and U.S. Aerospace Engineers and Scientists

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INTRODUCTION

Rapidly changing patterns of international cooperation and collaboration and revolutionary technological and managerial changes are combining to influence and transform the communication of technical information in the workplace. To contribute to our understanding of workplace culture, organization, and communications at the national and international levels, an exploratory study was conducted that investigated the technical communications practices of aerospace engineers and scientists at three similar research organizations in Russia and the United States (U.S.). Previous work includes exploratory studies of the technical communications practices of aerospace engineers and scientists in Israel [1], Japan [2][3], selected Western European countries [4], and the U.S. [5][6].

The data reported herein were collected through self-administered questionnaires undertaken as a Phase 4 activity of the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. The Russian/U.S. study included the following objectives:

1. To solicit the opinions of aerospace engineers and scientists regarding the importance of technical communications to their profession,

2. To determine the use and production of technical communications by aerospace engineers and scientists,

3. To seek their views about the appropriate content of an undergraduate course in technical communications,

4. To determine their use of libraries and technical information centers, and

5. To determine the use and importance of computer and information technology to them.

BACKGROUND

Aerospace engineering exhibits particular characteristics which make it an excellent platform for studying technical communications in the international workplace. The aerospace industry is becoming more international in scope and increasingly collaborative in nature, thus creating a multinational manufacturing environment. International industrial alliances will result in a more rapid diffusion of technology in order to enhance innovation and increase productivity. Aerospace producers will feel growing pressure to push forward with new technological developments, to maximize the inclusion of those developments into the research and development (R&D) process, and to maintain and improve the professional competency of aerospace engineers and scientists. Meeting these objectives at a reasonable cost depends on a variety of factors, but largely on the ability of aerospace engineers and scientists to acquire, process, and communicate scientific and technical information (STI). Access to STI can increase productivity and innovation and help aerospace engineers and scientists maintain and improve their professional skills. These same studies demonstrate, however, that little is known about how aerospace engineers and scientists find and use STI or how aerospace knowledge is diffused. To learn more about this process, researchers at the NASA Langley Research Center, the Indiana University Center for Survey Research, Rensselaer Polytechnic Institute, and institutions in selected countries are studying aerospace knowledge diffusion. These studies comprise the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. A project fact sheet appears in Appendix A.

Phase 1 of the project investigates the information-seeking behavior of U.S. aerospace engineers and scientists and places particular emphasis on their use of federally funded aerospace R&D and U.S. government technical reports. Phase 2 examines the industry-government interface and emphasizes the role of information intermediaries in the aerospace knowledge diffusion process. Phase 3 concerns the academic-government interface and focuses on the relationships between and among the information intermediary, faculty, and students. Phase 4 explores patterns of technical communications among non-U.S. aerospace engineers and scientists in selected countries [7]. A list of *NASA/DoD Aerospace Knowledge Diffusion Research Project* publications appears in Appendix B.

RESEARCH DESIGN AND METHODOLOGY

The research was conducted at comparable aeronautical research facilities, the Central Aero-Hydrodynamic Institute (TsAGI), the NASA Ames Research Center, and the NASA Langley Research Center, using self-administered (self-reported) mail surveys. The instrument used to collect the data had been used previously in several Western European countries and Japan and was adapted for use in Russia. Questionnaires were distributed to 325 researchers at TsAGI, and 209 were received by the established cut off date for a completion rate of 64 percent. Questionnaires were distributed to 558 researchers at the two NASA installations, and 340 were received by the established cut off date for a completion rate of 61 percent. The survey at TsAGI was conducted during April and May of 1992, and the surveys at the NASA Centers were conducted during July and August of 1992. The survey instruments used in Russia and the U.S appear in Appendixes C and D, respectively.

PRESENTATION OF THE DATA

This report presents selected results from Russian and U.S. studies, with Russian responses presented first followed by the U.S. responses. Demographic data, followed by data dealing with the importance of technical communications, workplace use and production of technical communications, appropriate course content for an undergraduate course in technical communications, use of libraries and technical information centers, and use of computer and information technology, are presented.

A-1

Demographic Information About the Survey Respondents

Survey respondents were asked to provide information regarding their professional duties, years of professional work experience, educational preparation, current professional duties, and gender. These demographic findings appear in table 1. A comparison of the two groups reveals some differences and similarities. The two groups differ significantly in education, current duties, and professional/technical society membership; they are similar in years of professional work experience, organizational affiliation, educational preparation, and gender.

The following "composite" participant profiles were based on these data. The Russian survey participant works as a researcher (77%), has a bachelor's degree (53%), was trained as an engineer (79%) but currently works as a scientist (68%), and has an average of 20 years professional work experience. The U.S. survey participant works as a researcher (82%), has a graduate degree (73%), was trained as an engineer (80%), currently works as an engineer (69%), has an average of 17 years of professional work experience, and belongs to a professional/technical society (78%).

Importance of and Time Spent on Technical Communications

Approximately 89% of the Russian respondents and 91% of the U.S. respondents indicated that the ability to communicate technical information effectively is important. (Importance was measured on a 5-point scale with 1 = very unimportant and 5 = very important; percentages = combined "4" and "5" responses.) Russian aerospace engineers and scientists spent an average of 8.75 hours per week communicating technical information to

Table 1. Demographic Findings

	Russia		U.S.	
	%	(n)	%	(n)
Professional Duties				
Design/development	13	(27)	6	(21)
Administration/management	2	(5)	11	(37)
Research	77	(160)	82	(279)
Other	8	(17)	1	(3)
Organizational Affiliation				
Government	100	(209)	100	(340)
Professional Work Experience				
1 - 5 years	4	(9)	15	(52)
6 - 10 years	22	(46)	22	(74)
11 - 20 years	34	(71)	28	(95)
21 - 40 years	37	(77)	34	(115)
41 or more years	3	(6)	1	(4)
Russia / U.S.				
Mean: 20 / 17				
Median: 17 / 14				
Education				
Bachelor's degree or less	53	(110)	27	(91)
Graduate degree	47	(99)	73	(249)
Educational Preparation				
Engineer	79	(164)	80	(273)
Scientist	21	(45)	17	(58)
Other	0	(0)	3	(9)
Current Duties				
Engineer	31	(65)	69	(234)
Scientist	68	(142)	27	(92)
Other	1	(2)	4	(14)
Member of a Professional/ Technical Society	22	(46)	78	(265)
Gender				
Female	15	(32)	15	(50)
Male	85	(177)	85	(290)

others; U.S. aerospace engineers and scientists spent an average of 16.95 hours per week. Russian aerospace engineers and scientists spent an average of 7.64 hours per week, and U.S. aerospace engineers and scientists spent an average of 13.97 hours per week working with communications received from others (table 2).

Table 2. Mean (Median) Number of Hours Spent Each Week by Russian and U.S. Aerospace Engineers and Scientists Communicating Technical Information

	Russia	U.S.
Communicating With Others	8.75 (7.00) hours/week	16.95 (15.0) hours/week
Working With Communications Received From Others	7.64 (6.00) hours/week	13.97 (12.0) hours/week
Percent of Work Week Devoted to Technical Communications*	41%	77%

* Based on a 40-hour work week

Considering both the time spent communicating information with others and working with communications received from others, technical communications takes up approximately 41% of the Russian aerospace engineer's and scientist's 40-hour work week and 77% of the U.S. aerospace engineer's and scientist's work week.

Approximately 30% of the Russian respondents and 70% of the U.S. respondents indicated that the amount of time they spent communicating technical information had increased over the past 5 years (table 3). Forty-one percent of the Russian respondents and 24% of the U.S. respondents indicated that the amount of time they spent communicating technical information had stayed the same over the past 5 years. Twenty-nine percent of the

Russian respondents and 6% of the U.S. respondents indicated that the amount of time they spent communicating technical information had decreased over the past 5 years.

Table 3. Changes in the Past 5 Years in the Amount of Time Spent Communicating Technical Information by Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	%	(n)	%	(n)
Increased	30	(63)	70	(239)
Stayed the Same	41	(85)	24	(80)
Decreased	29	(61)	6	(6)

As they have advanced professionally, 38% of the Russian respondents have increased the amount of time they spend communicating technical information. Likewise, 65% of the U.S. respondents indicated that, as they have advanced professionally, they have increased the amount of time they spend communicating technical information (table 4).

Table 4. Changes in the Amount of Time Spent Communicating Technical Information as a Part of Professional Advancement by Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	%	(n)	%	(n)
Increased	38	(80)	65	(221)
Stayed the Same	45	(94)	26	(87)
Decreased	17	(35)	9	(32)

The Production and Use of Technical Communications

The process of collaborative writing was examined as part of this study. Survey participants were asked whether they wrote alone or as part of a group (table 5). Only 7% of the Russian respondents and 15% of the U.S. respondents write alone. Although a higher

Table 5. Collaborative Writing Practices of Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	*%	(n)	*%	(n)
I Write Alone	7	(14)	15	(50)
I Write With One Other Person	69	(145)	72	(246)
I Write With a Group of 2 to 5 Persons	83	(174)	61	(208)
I Write With a Group of More Than 5 Persons	20	(42)	14	(47)

* Percentages do not total 100

percentage of Russian than U.S. respondents writes with a group of 2 to 5 persons or with a group of more than 5 persons, writing appears to be a collaborative process for both groups.

Russian and U.S. aerospace engineers and scientists were asked to assess the influence of group participation on writing productivity (table 6). Only 44% of the Russian respon-

Table 6. Influence of Group Participation on Writing Productivity For Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	%	(n)	%	(n)
A Group Is More Productive Than Writing Alone	44	(92)	33	(110)
A Group Is About As Productive As Writing Alone	41	(86)	32	(107)
A Group Is Less Productive Than Writing Alone	8	(17)	20	(68)
I Only Write Alone	7	(14)	15	(50)

dents and 33% of the U.S. respondents indicated that group writing is more productive than writing alone. Forty-one percent of the Russian respondents and 32% of the U.S. respondents found that group writing is about as productive as writing alone, and 8% of the Russian respondents and 20% of the U.S. respondents found that writing in a group is less productive than writing alone.

Of those respondents who did not write alone, 50% of the Russian group and 47% of the U.S. group worked with the same group when producing written technical communications (table 7). The average number of people in the Russian group was $\bar{X}$ = 3.39 and the

Table 7. Production of Written Technical Communications as a Function of Number of Groups and Group Size For Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	%	(n)	%	(n)
Worked With Same Group				
Yes	50	(105)	47	(161)
No	43	(90)	38	(129)
I Only Write Alone	7	(14)	15	(50)
Number of People in Group				
Mean	3.39	(105)	3.21	(161)
Median	3.00	(105)	3.00	(161)
Number of Groups				
Mean	2.82	(90)	2.82	(129)
Median	2.00	(90)	3.00	(129)
Number of People in Each Group				
Mean	3.38	(90)	3.03	(129)
Median	3.00	(90)	3.00	(129)

average number in the U.S. group was $\bar{X}$ = 3.21. Forty-three percent of the Russian respondents worked in an average (mean) number of 2.82 groups, each group containing an average of 3.38 people. Thirty-eight percent of the U.S. respondents worked in an average (mean) number of 2.82 groups, each group containing an average of 3.03 people.

From a prepared list, both groups were asked to indicate the number of times they had prepared, either alone or as a member of a group, specific technical information products. As single authors, Russian respondents most frequently prepared drawings/specifications, memoranda, letters, abstracts, and computer program documentation (table 8).

Table 8. Mean (Median) Number of Technical Information Products Produced in the Past 6 Months by Russian Aerospace Engineers and Scientists

	Alone		In a Group		Average Number of Persons Per Group	
	Mean	Median	Mean	Median	Mean	Median
Abstracts	6.13	(2.00)	1.82	(1.50)	2.61	(2.00)
Journal Articles	1.43	(1.00)	1.48	(1.00)	2.55	(2.00)
Conference/Meeting Papers	2.00	(1.00)	1.53	(1.00)	2.96	(2.00)
Trade/Promotional Literature	0.00	(0.00)	3.00	(1.00)	3.00	(3.00)
Drawings/Specifications	8.29	(5.00)	12.40	(2.00)	3.10	(2.00)
Audio/Visual Material	1.50	(1.50)	4.43	(1.00)	2.71	(2.00)
Letters	6.24	(5.00)	3.82	(2.00)	2.86	(2.00)
Memoranda	6.46	(3.00)	2.40	(2.50)	2.20	(2.00)
Technical Proposals	3.03	(2.00)	2.02	(2.00)	3.81	(3.00)
Technical Manuals	1.67	(1.00)	1.60	(1.00)	2.67	(2.00)
Computer Program Documentation	5.73	(2.00)	2.83	(1.50)	2.50	(2.00)
In-house Technical Reports	2.76	(2.00)	2.71	(2.00)	3.65	(3.00)
Technical Talks/Presentations	1.70	(1.00)	1.54	(1.00)	2.52	(2.00)

Working as a group, Russian aerospace engineers and scientists most frequently **prepared** drawings/specifications, audio/visual materials, letters, trade/promotional literature, and computer program documentation. For these products, the mean number of persons per group ranged from a high of $\bar{X}$ = 3.10 to a low of $\bar{X}$ = 2.00.

As single authors, U.S. respondents most frequently **prepared** memoranda, letters, drawings/specifications, audio/visual materials, and technical talks/presentations (table 9). As a group, U.S. aerospace engineers and scientists most frequently prepared letters, audio/visual materials, memoranda, drawings/specifications, and technical talks/presentations. For these products, the mean number of persons per group ranged from a high of $\bar{X}$ = 3.50 to a low of $\bar{X}$ = 2.00.

Table 9. Mean (Median) Number of Technical Information Products Produced in the Past 6 Months by U.S. Aerospace Engineers and Scientists

	Alone		In a Group		Average Number of Persons Per Group	
	Mean	Median	Mean	Median	Mean	Median
Abstracts	1.67	(1.00)	1.81	(1.00)	2.67	(2.00)
Journal Articles	1.33	(1.00)	1.75	(1.00)	2.74	(2.00)
Conference/Meeting Papers	1.90	(1.00)	1.54	(1.00)	2.79	(3.00)
Trade/Promotional Literature	2.00	(1.00)	1.00	(1.00)	2.50	(2.50)
Drawings/Specifications	7.21	(3.00)	3.83	(3.00)	3.02	(2.00)
Audio/Visual Material	5.73	(4.00)	5.82	(2.00)	2.95	(2.00)
Letters	9.96	(6.00)	5.95	(3.00)	2.32	(2.00)
Memoranda	16.06	(9.00)	5.14	(3.50)	2.55	(2.00)
Technical Proposals	2.17	(2.00)	2.64	(1.50)	2.61	(2.00)
Technical Manuals	2.11	(1.00)	2.11	(1.00)	3.11	(3.00)
Computer Program Documentation	3.43	(2.00)	2.20	(1.50)	2.35	(2.00)
In-house Technical Reports	2.34	(2.00)	1.80	(1.00)	2.87	(2.00)
Technical Talks/Presentations	3.54	(2.00)	3.07	(2.00)	3.46	(3.00)

Journal articles, abstracts, letters, memoranda, and computer program documentation were the technical information products most frequently **used** by Russian aerospace engineers and scientists (table 10). On the average, they **used** 18 journal articles, 16 abstracts, 13 letters, 10 memoranda, and 9 computer program documentation products in a 6-month period. Audio/visual materials, technical proposals, trade/promotional literature, technical talks/presentations, and technical manuals were the technical information products least frequently **used** by Russian aerospace engineers and scientists during a 6-month period.

Memoranda, letters, journal articles, abstracts, and drawings/specifications were the technical information products most frequently **used** by U.S. aerospace engineers and scientists. On the average, they **used** 25 memoranda, 17 letters, 16 journal articles, 16 abstracts, and 15 drawings/specifications during a 6-month period. Technical proposals, in-

Table 10. Mean (Median) Number of Technical Information Products Used in the Past 6 Months by Russian and U.S. Aerospace Engineers and Scientists

	Russia		U.S.	
	Mean	Median	Mean	Median
Abstracts	16.48	(6.00)	16.45	(10.00)
Journal Articles	18.33	(7.50)	16.54	(10.00)
Conference/Meeting Papers	6.71	(3.00)	12.00	(10.00)
Trade/Promotional Literature	4.97	(2.00)	11.77	(6.00)
Drawings/Specifications	6.63	(5.00)	15.48	(5.00)
Audio/Visual Material	2.66	(2.00)	14.59	(5.00)
Letters	13.11	(8.00)	17.28	(9.00)
Memoranda	10.12	(5.50)	25.44	(10.00)
Technical Proposals	4.41	(3.00)	5.89	(2.00)
Technical Manuals	5.26	(3.00)	7.65	(5.00)
Computer Program Documentation	9.61	(5.00)	14.57	(5.00)
In-house Technical Reports	8.61	(5.00)	6.93	(5.00)
Technical Talks/Presentations	5.08	(3.00)	10.25	(6.00)

house technical reports, technical manuals, technical talks/presentations, and drawings/specifications were the technical information products least frequently **used** by U.S. aerospace engineers and scientists during a 6-month period.

The types of technical information most frequently **produced** by Russian aerospace engineers and scientists included in-house technical data, computer programs, basic scientific and technical information, experimental techniques, and patents and inventions (table 11). The types of technical information least frequently **produced** by Russian aerospace engineers and scientists included codes of standards and practices, technical specifications, and product and performance characteristics. Basic scientific and technical information, in-house technical data, experimental techniques, computer programs, and technical specifications were the kinds of technical information most frequently **produced** by U.S. aerospace engineers and scientists. Codes of standards and practices, patents and inventions, and product and performance characteristics were the kinds of technical information least frequently **produced** by U.S. aerospace engineers and scientists.

Table 11. Types of Information Produced by Russian and U.S. Aerospace Engineers and Scientists
[n = 209; 340]

	Russia %	U.S. %
Basic Scientific and Technical Information	48	92
Experimental Techniques	46	65
Codes of Standards and Practices	19	9
Computer Programs	56	61
In-house Technical Data	83	86
Product and Performance Characteristics	29	32
Technical Specifications	23	45
Patents and Inventions	31	25

The types of technical information most frequently **used** by Russian aerospace engineers and scientists included basic scientific and technical information, in-house technical data, computer programs, experimental techniques, and codes of standards and practices (table 12). The types of technical information least frequently **used** by Russian aerospace engineers and scientists included economic information, technical specifications, and patents and inventions. Basic scientific and technical information, in-house technical data, computer programs, experimental techniques, and technical specifications were the types of technical information most frequently **used** by U.S. aerospace engineers and scientists. Patents and inventions, economic information, and codes of standards and practices were the types of technical information least frequently **used** by U.S. aerospace engineers and scientists.

From a list of information sources, survey participants were asked to indicate which ones they routinely used in problem solving (table 13). In addition to personal knowledge,

Table 12. Types of Information Used by Russian and U.S. Aerospace Engineers and Scientists
[n = 209; 340]

	Russia %	U.S. %
Basic Scientific and Technical Information	87	97
Experimental Techniques	51	82
Codes of Standards and Practices	44	36
Computer Programs	63	89
In-house Technical Data	80	90
Product and Performance Characteristics	43	63
Economic Information	27	19
Technical Specifications	33	69
Patents and Inventions	38	12

upon which they rely greatly, the U.S. aerospace engineers and scientists in this study display information-seeking behavior patterns similar to those of U.S. engineers in general.

Table 13. Information Sources Used by Russian and U.S. Aerospace Engineers and Scientists in Problem Solving
[n = 209; 340]

	Russia		U.S.	
	%	(n)	%	(n)
Personal Store of Technical Information	51	(106)	99	(373)
Spoke With a Co-Worker or People Inside My Organization	90	(187)	98	(371)
Spoke With Colleague Outside My Organization	36	(75)	93	(318)
Used Literature Resources Found in My Organization's Library	85	(178)	91	(310)
Spoke With a Librarian or Technical Information Specialist	59	(123)	80	(214)

The information-seeking behavior of the Russian participants varied from that of their American counterparts. U.S. participants used their personal store of technical information, co-workers in the organization, colleagues outside the organization, literature resources found in the organization's library, and a librarian or technical information specialist. Their Russian counterparts spoke with co-workers in the organization, used literature resources found in the organization's library, spoke with a librarian or technical information specialist, used their personal stores of technical information, and spoke with a colleague outside the organization.

Content for an Undergraduate Course in Technical Communications

Russian and U.S. survey participants were asked their opinions regarding an undergraduate course in technical communications for aerospace majors. Approximately 25% of the Russian respondents and 71% of the U.S. respondents indicated that they had taken a course(s) in technical communications/writing. Approximately 11% of the Russian participants had taken a course(s) as undergraduates, approximately 7% had taken a course(s) after graduation, and about 7% had taken a course(s) both as undergraduates and after graduation. Approximately 20% of the U.S. respondents had taken a course(s) as undergraduates, approximately 19% had taken a course(s) after graduation, and 32% had taken a course(s) both as undergraduates and after graduation.

Of the 25% (52 respondents) of the Russian engineers and scientists who had taken coursework in technical communications/writing, about 23% (49 respondents) of them indicated that doing so had helped them to communicate technical information. Of the 70% (241 respondents) of the U.S. engineers and scientists who had taken a course(s) in technical communications/writing, about 67% (233 respondents) indicated that doing so had helped them to communicate technical information.

Russian and U.S. participants were asked their opinion regarding the desirability of undergraduate aerospace majors taking a course in technical communications. Approximately 63% of the Russian respondents and 90% of the U.S. participants indicated that aerospace majors should take such a course. Approximately 18% of the Russian participants and about 80% of the U.S. participants indicated that the course should be taken for credit (table 14).

Table 14. Opinions Regarding an Undergraduate Course in Technical Communications for Aerospace Majors

	Russia		U.S.	
	%	(n)	%	(n)
Taken for Credit	18	(37)	80	(269)
Not Taken for Credit	30	(63)	7	(23)
Don't Know	15	(31)	4	(15)
Should Not Have to Take a Course in Technical Communications	37	(78)	10	(33)

The Russian participants were asked if undergraduate aerospace engineering and science majors should take a course in technical communications and, if so, how the course should be offered? About 63% (131 respondents) of the Russian participants indicated "**yes**," that students should take a course in technical communications. About 16% of the Russian respondents indicated that the course should be taken as part of a "required" course, about 24% thought the course should be taken as part of an "elective" course, about 18% thought it should be taken as a "separate" course, about 5% did not have an opinion, and 37% of the Russian respondents indicated that undergraduate aerospace engineering and science students should **not have to take** a course in technical communications/writing.

Russian and U.S. respondents were asked to select from similar lists appropriate principles for inclusion in an undergraduate technical communications course for aerospace engineering and science students. Table 15 shows their responses.

Table 15. Recommended Principles for an Undergraduate Technical Communications Course for Aerospace Majors

Principles	Russian*		U.S.	
	%	(n)	%	(n)
Organizing Information	40	(84)	97	(329)
Defining the Communication's Purpose	39	(82)	91	(310)
Developing Paragraphs	48	(101)	87	(296)
Assessing Reader's Needs	35	(74)	87	(295)
Choosing Words	49	(102)	83	(283)
Note Taking and Quoting	43	(90)	44	(149)
Editing and Revising	37	(77)	87	(295)

* About 37% (78) of the 209 Russian participants indicated that undergraduate aerospace engineering and science majors should not have to take a technical communications course.

The Russian respondents indicated that matters of correctness such as style and form of publications, word choice, note-taking and quoting, were more important than process-oriented concerns such as organizing information, defining purpose, and assessing readers' needs, concerns which typically are stressed in U.S. undergraduate writing courses. The U.S. respondents, on the other hand, selected the holistic concerns of organizing information, defining the communication's purpose, and assessing readers' needs over those principles that deal more specifically with matters of correctness, although both groups of respondents did select developing paragraphs as one of the top five principles for inclusion.

It is interesting to speculate about why such differences occur. Are they attributable to demographic, institutional, or cultural differences? For example, many Russian respondents reported that they work as scientists despite having been trained as engineers, so a concern about accurate and correct reporting of information is compatible with the communications needs of their professional community. The finding that 86% of the Russians reported that publishing in the professional literature is important for professional advancement is consistent with knowing forms and styles of publication. Perhaps institutional or cultural differences between the two groups of respondents regarding the dissemination of information as a resource for problem solving would account for the selection of different principles which are being taught. Is it likely that Russian aerospace students are already such skilled communicators, given the highly competitive nature of higher education in their country, that they have already mastered the holistic concerns of composing effective written communications? Is the teaching of writing a component of Russian aerospace curricula and, if so, is writing more product-oriented than process-oriented, unlike the teaching of writing in most U.S. colleges and universities where considerable attention is devoted to the processes of inventing and composing?

Russian and U.S. respondents also chose from a list of specific topics those mechanics to be included in an undergraduate technical communications course for aerospace students. Their responses appear in table 16.

Although both groups of respondents indicated that references, abbreviations, and symbols belong in the top-five list for inclusion, the Russian respondents again focused on the accurate and correct presentation of scientific and technical data. They also placed relations between different systems of measurement, acronyms, and numbers in the top-five list, whereas the U.S. respondents selected punctuation, capitalization, and spelling for the top-five list. Perhaps these differences are attributable to the same demographic, cultural, or institutional differences that influenced the selection of appropriate principles for inclusion in a technical communications course.

Table 16. Recommended Mechanics for an Undergraduate Technical Communications Course for Aerospace Majors

Mechanics	Russian*		U.S.	
	%	(n)	%	(n)
References	47	(99)	80	(272)
Symbols	38	(80)	64	(218)
Punctuation	22	(46)	74	(251)
Spelling	23	(48)	55	(187)
Abbreviations	44	(91)	55	(187)
Numbers	27	(56)	48	(163)
Capitalization	24	(51)	54	(182)
Acronyms	27	(56)	52	(176)

* About 37% (78) of the 209 Russian participants indicated that undergraduate aerospace engineering and science majors should not have to take a technical communications course.

Given a list of 13 items, the Russian and U.S. respondents were next asked to select appropriate on-the-job communications to be included in an undergraduate technical communications course for aerospace students. Their responses appear in table 17.

Both groups selected journal articles, technical reports, conference/meeting papers, oral presentations, literature reviews, letters, memos, use of information sources, and technical instructions for inclusion, although not in the same order of appearance. It is interesting to note that more similarities than differences exist among their choices for the types of written communications that students should learn to produce. These choices also probably reflect information acquisition and use patterns among aerospace professionals.

Table 17. Recommended On-the-Job Communications To Be Taught in an Undergraduate Technical Communications Course for Aerospace Majors

On-the-Job Communications	Russian*		U.S.	
	%	(n)	%	(n)
Oral Technical Presentations	50	(105)	92	(311)
Abstracts	53	(110)	85	(289)
Use of Information Sources	46	(96)	72	(244)
Conference/Meeting Papers	50	(104)	67	(228)
Technical Reports	51	(106)	81	(274)
Technical Instructions	40	(84)	62	(212)
Journal Articles	57	(120)	64	(217)
Letters	47	(98)	61	(208)
Technical Specifications	36	(75)	45	(152)
Literature Reviews	48	(101)	50	(169)
Memoranda	34	(70)	60	(204)
Technical Manuals	34	(71)	43	(147)
Newsletter/Paper Articles	39	(81)	15	(50)

* About 37% (78) of the 209 Russian participants indicated that undergraduate aerospace engineering and science majors should not have to take a technical communications course.

In an attempt to validate these findings, the top-10 on-the-job communications were paired with the top-five (on the average) technical communication products "produced" and "used" by Russian and U.S. respondents. (See table 18.)

The on-the-job communications recommended by Russian respondents do not appear to closely reflect the types of communications they produce and use, nor do the responses of the U.S. respondents appear to reflect the types of communications they produce and use. Perhaps the differences are attributable to the institutional cultures of both groups of respondents. It is interesting to note that although neither group places technical reports in the top-five category of communications produced or used, both groups recommended that report writing be taught. Technical reports, which can be expected to yield valuable information for researchers, are often collaboratively written and are lengthy and time-consuming to produce. Additionally, they are sometimes difficult to acquire for a variety of reasons.

Table 18. Comparison of Russian and U.S. Responses
Concerning Technical Information Products
Produced, Used, and Recommended

Russian	U.S.
Produced Drawing/Specifications Memoranda Letters Abstracts Computer Program Documentation	Produced Memoranda Letters Drawings/Specifications Audio/Visual Material Technical Talks/Presentations
Used Journal Articles Abstracts Letters Memoranda Computer Program Documentation	Used Memoranda Letters Journal Articles Abstracts Drawings/Specifications
Recommended Journal Articles Abstracts Technical Reports Conference/Meeting Papers Oral Presentations Literature Reviews Letters Use of Information Sources Technical Instructions Newsletter/Paper Articles	Recommended Oral Presentations Abstracts Technical Reports Use of Information Sources Conference/Meeting Papers Journal Articles Technical Instructions Letters Memoranda Literature Reviews

It would be interesting to ascertain if a relationship exists between the recommendation by both groups of respondents to teach technical report writing and information acquisition skills (use of information sources). Certainly information acquisition skills need to be developed as an important part of effective communications in light of an expanding international knowledge base and the array of information technology that is becoming available to many users.

Use of Libraries and Technical Information Centers

Almost all of the respondents indicated that their organization has a library or technical information center. Unlike the U.S. respondents (9%), about 45% of the Russian respondents indicated that the library or technical information center was located in the building where they worked. About 53% of the Russian and 88% of the U.S. respondents indicated that the library or technical information center was outside the building in which they worked and that it was located nearby where they worked. For about 49% of the Russians, the library or technical information center was located 1.4 kilometers or less from where they worked. For about 81% of the U.S. respondents, the library or technical information center was located 1.0 mile or less from where they worked.

Respondents were asked to indicate the number of times they had visited their organization's library or technical information center in the past 6 months (table 19). Overall, the Russian respondents used their organization's library or technical information center more than their U.S. counterparts did. The average use rate for Russian aerospace engineers and scientists was $\bar{X} = 12.5$ during the past 6 months compared to $\bar{X} = 9.2$ for the U.S. aerospace engineers and scientists. The median 6-month use rates for the two groups were 10.0 and 4.0, respectively.

Respondents were also asked to rate the importance of their organization's library or technical information center (table 20). Importance was measured on a 5-point scale with 1 = not at all important and 5 = very important. A majority of both groups indicated that their organization's library or technical information center was important to performing their present professional duties. About 83% of the Russian aerospace engineers and scientists indicated that their organization's library or technical information center was very important to performing their present professional duties. About 68% of the U.S. aerospace engineers and scientists indicated that their organization's library or technical information center was very important to performing their present professional duties. About 2% of the Russian respondents and about 13% of the U.S. respondents indicated that their organization's library or technical information center was very unimportant to performing their present professional duties.

Table 19. Use of the Organization's Library in Past 6 Months
by Russian and U.S. Aerospace Engineers and Scientists

Visits	Russian		U.S.	
	%	(n)	%	(n)
0 times	4	(9)	11	(37)
1 - 5 times	31	(65)	43	(145)
6 - 10 times	34	(71)	21	(73)
11 - 25 times	19	(40)	14	(49)
26 - 50 times	6	(13)	7	(22)
51 or more times	2	(5)	1	(4)
Does not have a library	3	(6)	3	(11)
Mean	12.5		9.2	
Median	10.0		4.0	

Table 20. Importance of the Organization's Library
to Russian and U.S. Aerospace Engineers and Scientists

	Russian		U.S.	
	%	(n)	%	(n)
Very Important	82.8	(173)	68.3	(232)
Neither Important nor Unimportant	12.4	(26)	15.6	(53)
Very Unimportant	2.0	(4)	12.9	(44)
Do not have a library	2.8	(6)	3.2	(11)

Use and Importance of Computer and Information Technology

Survey participants were asked if they use computer technology to prepare technical information. About 83% of the Russian respondents use computer technology to prepare technical information. Almost all (98%) of the U.S. respondents use computer technology to prepare tech :cal information. About 16% of the Russian respondents and about 73% of the U.S. respondents "always" use computer technology to prepare technical information. A majority of both groups (76% and 98%) indicated that computer technology had increased their ability to communicate technical information. About 37% of the Russian respondents and 80% of the U.S. respondents stated that computer technology had increased their ability to communicate technical information "a lot".

From a prepared list, survey respondents were asked to indicate which computer software they used to prepare written technical information (table 21). Word processing software was used most frequently by both groups. With the exception of **outliners and**

Table 21. Use of Computer Software by Russian and U.S. Aerospace Engineers and Scientists to Prepare Written Technical Communications

	Russian		U.S.	
Software	%	(n)	%	(n)
Word Processing	72	(150)	96	(327)
Outliners and Prompters	34	(72)	14	(46)
Grammar and Style Checkers	11	(22)	30	(103)
Spelling Checkers	17	(35)	88	(299)
Thesaurus	12	(26)	37	(127)
Business Graphics	24	(50)	15	(52)
Scientific Graphics	53	(110)	91	(308)
Desktop Publishing	4	(9)	47	(162)

prompters and **business graphics**, the U.S. respondents made greater use of computer software for preparing written technical communications than did their Russian counterparts.

Survey respondents were also given a list of information technologies. They were asked, "*How do you view your use of the following information technologies in communicating technical information?*" Their choices included "already use it"; don't use it, but may in the future"; and "don't use it and doubt if I will".

Russian and U.S. aerospace engineers and scientists use a variety of information technologies. The percentages of "I already use it" responses ranged from a high of 58% (computer cassettes/cartridge tapes) to a low of 1% (laser disk/video disk/CD-ROM) for Russian respondents. Similarly, the U.S. responses ranged from a high of 91% (FAX or TELEX) to a low of 13% (audio tapes and cassettes).

Table 22. Use, Nonuse, and Potential Use of Information Technologies by Russian and U.S. Aerospace Engineers and Scientists

	Already Use It		Don't Use It, But May in Future		Don't Use It and Doubt If Will	
Information Technologies	Russia %	U.S. %	Russia %	U.S. %	Russia %	U.S. %
Audio Tapes and Cassettes	12	13	22	30	34	57
Motion Picture Film	20	17	19	29	28	55
Videotape	15	63	37	31	19	7
Desktop/Electronic Publishing	5	60	41	32	14	8
Computer Cassettes/Cartridge Tapes	58	44	20	32	3	24
Electronic Mail	2	83	48	15	11	2
Electronic Bulletin Boards	2	36	43	48	10	17
FAX or TELEX	21	91	37	8	9	1
Electronic Data Bases	25	56	46	40	6	4
Video Conferencing	2	37	31	54	33	10
Teleconferencing	2	53	28	40	32	7
Micrographics and Microforms	54	23	12	42	9	34
Laser Disk/Video Disk/CD-ROM	1	19	44	68	17	14
Electronic Networks	3	76	51	19	12	5

A list, in descending order, follows of the information technologies most frequently used.

Russian		U.S.	
Computer Cassettes/ Cartridge Tapes	58%	FAX or TELEX	91%
Micrographics and Microforms	54	Electronic Mail	83
Electronic Data Bases	25	Electronic Networks	76
FAX or TELEX	21	Videotape	63
Motion Picture Film	20	Desktop Publishing	60

A list, in descending order, follows of the information technologies "that are not currently being used but may be used in the future."

Russian		U.S.	
Electronic Networks	51%	Laser Disk/Video Disk/ CD-ROM	68%
Computer Cassettes/ Cartridge Tapes	48	Video Conferencing	54
Electronic Data Bases	46	Electronic Bulletin Boards	48
Laser Disk/Video Disk/ CD-ROM	44	Micrographics and Microforms	42
Electronic Bulletin Boards	43	Electronic Data Bases	40

DISCUSSION

Given the limited purposes of this exploratory study, the overall response rates, and the research designs, no claims are made regarding the extent to which the attributes of the respondents in the studies accurately reflect the attributes of the populations being studied. A much more rigorous research design and methodology would be needed before any claims could be made. Nevertheless, the findings of the studies do permit the formulation of the following general statements regarding the technical communications practices of the aerospace engineers and scientists who participated in the two studies:

1. The ability to communicate technical information effectively is important to Russian and U.S. aerospace scientists and engineers.

2. As the Russian and U.S. aerospace engineers and scientists in these studies have advanced professionally, the amount of time they spend producing and working with technical communications has increased for more than one-third (38%) of the Russian respondents and more than two-thirds (68%) of the U.S. respondents.

3. The Russian and U.S. aerospace engineers and scientists in these studies write more frequently in small groups than they write alone, although they do not necessarily find collaborative writing more productive than individual writing. Both groups of respondents frequently produce the same types of materials whether they write as members of a group or as individuals.

4. The U.S. aerospace engineers and scientists in these studies make use of personal knowledge and discussions with colleagues within and outside their organization for solving technical problems. However, the Russian respondents appear to rely on co-workers or people within the organization and literature resources found within the organization's library.

5. Approximately 25% of the Russian and 71% of the U.S. aerospace engineers and scientists in these studies had taken a course in technical communications; a majority of both groups indicated that such a course had helped them communicate technical information.

6. Although the percentages vary for each item, there was considerable agreement among the Russian and U.S. aerospace engineers and scientists in these studies regarding the on-the-job communications to be included in an undergraduate technical communications course for aerospace and science students and less agreement on the appropriate principles and mechanics that should be included in such a course.

7. Although important to both Russian and U.S. aerospace engineers and scientists, libraries and technical information centers were used more by the Russian respondents. More Russian aerospace engineers and scientists had a library or technical information center located in their building than did their U.S. counterparts.

8. More U.S. respondents used computer technology to prepare technical information than did their Russian counterparts and a larger percentage of the U.S. than Russian respondents indicated that computer technology had increased their ability to communicate technical information.

9. U.S. aerospace engineers and scientists made greater use of computer software than did their counterparts.

10. There were substantial differences between the two groups in terms of the information technologies presently being used and those that might be used in the future.

CONCLUDING REMARKS

Despite the limitations of this investigation, these findings contribute to our knowledge and understanding of the technical communications practices among aerospace engineers and scientists at the national and international levels. The findings reinforce some of the conventional wisdom regarding the nature and importance of technical communications and the amount of time engineers and scientists devote to communicating technical information. The findings hold implications for technical communicators, curriculum developers, and R&D managers and raise questions in the following areas.

If technical communications consumes approximately 41% and 77% of a 40-hour week for Russian and U.S. aerospace engineers and scientists, respectively, and plays a significant role in professional advancement, to what extent do aerospace engineers and scientists receive technical communications training as part of their academic preparation? Approximately 63% of the Russian respondents and 90% of the U.S. respondents indicated that undergraduate aerospace engineering and science majors should take a course in technical communications. Are they required or encouraged to take such a course? Russian and U.S. aerospace engineers and scientists suggested the inclusion of oral presentation skills (50% and 92%), journal article writing (57% and 64%), using references (47% and 80%), and developing paragraphs (48% and 87%) in an undergraduate course in technical communications for aerospace engineering and science majors. Are these principles, mechanics, and on-the-job communications included in the technical communications courses available to under- graduate aerospace engineering and science majors? Much more work must be done to increase our understanding of aerospace engineers' and scientists' technical communications practices at the national and international levels.

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APPENDIX A

NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

Fact Sheet

A research study is investigating the production, transfer, and use of scientific and technical information (STI) in aerospace, a community which is becoming more interdisciplinary in nature and more international in scope. Sponsored by National Aeronautics Space Administration the Aerospace Knowledge Diffusion Research Project is being conducted by the Indiana University Center for Survey Research, the NASA Langley Research Center, and RPI with the cooperation of the AGARD and AIAA technical information panels.

This 4-phase project will provide descriptive and analytical data regarding the flow of STI at the individual, organizational, national, and international levels. It will examine both the channels used to communicate STI and the social system of the aerospace knowledge diffusion process. The results of the Project should provide useful information to R&D managers, information managers, and others concerned with improving access to and utilization of STI. Phases 1 and 4 investigate the information-seeking habits and practices of U.S. and non-U.S. aerospace engineers and scientists and place particular emphasis on their use of government funded aerospace STI. Phase 2 examines the industry-government interface and places particular emphasis on the role of the information intermediary in the knowledge diffusion process. Phase 3 concerns the academic-government interface and places particular emphasis on the information intermediary-faculty-student interface.

Empirically, little is known about the production, transfer, and use of aerospace STI in general and about the information-seeking behavior of aerospace engineers and scientists in particular. Less is known about the effectiveness of information intermediaries and the role(s) they play in knowledge diffusion. It is generally assumed that information intermediaries play a significant role in the aerospace knowledge diffusion process. However, a strong methodological base for measuring or assessing their effectiveness is lacking.

The ability of aerospace engineers and scientists to identify, acquire, and utilize STI is of paramount importance to the efficiency of the R&D process. An understanding of the process by which aerospace STI is communicated through certain channels over time among members of the social system would contribute to increasing productivity, stimulating innovation, and improving and maintaining the professional competence of aerospace engineers and scientists.

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APPENDIX B

NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT PUBLICATIONS

REPORTS

Report No.

1 PART 1 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 106 p. (Available from NTIS 89N26772.)

1 PART 2 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of a Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 83 p. (Available from NTIS 89N26773.)

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Paper No.

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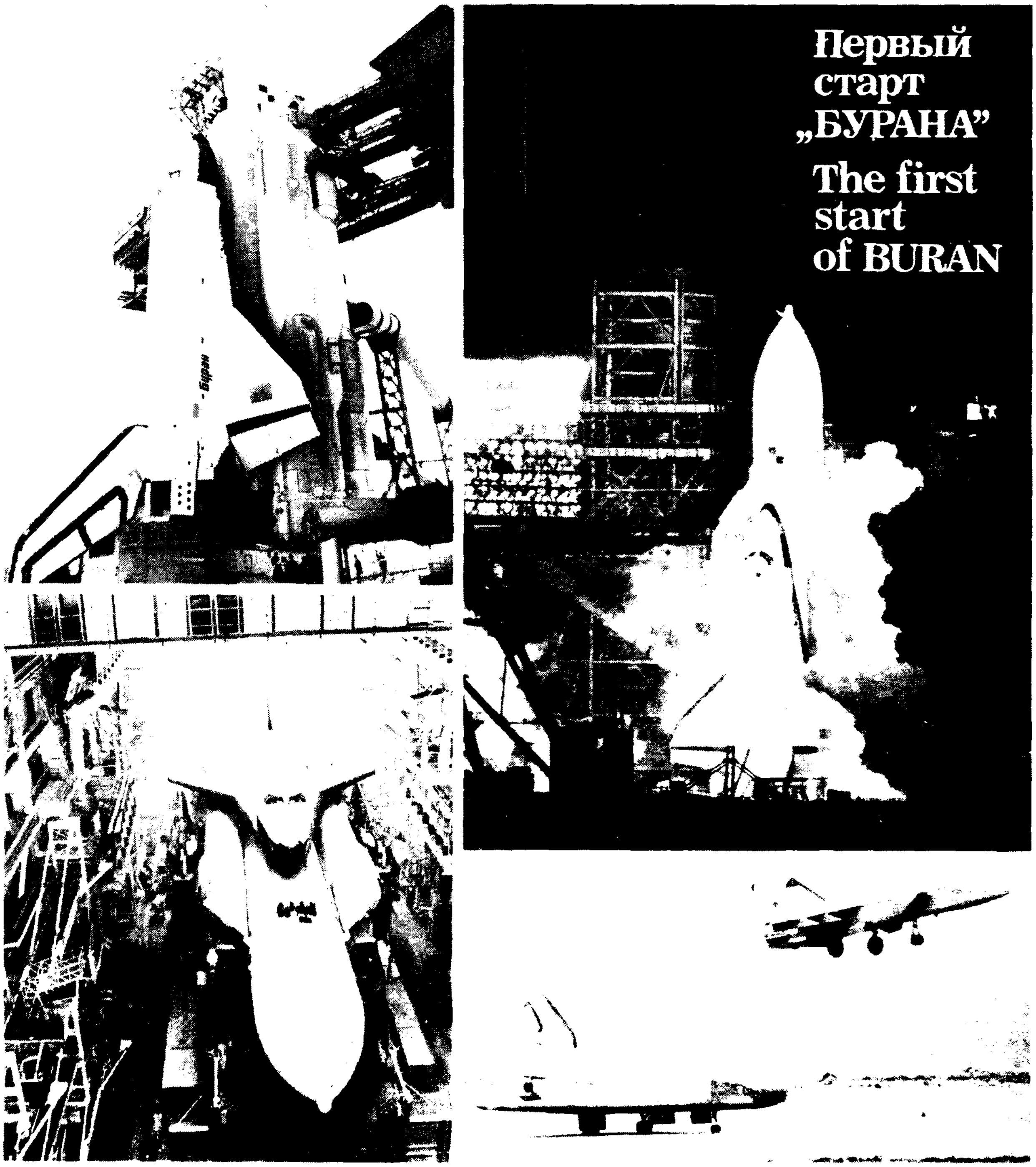
APPENDIX C
RUSSIAN SURVEY INSTRUMENT

НАУЧНО-ТЕХНИЧЕСКАЯ ИНФОРМАЦИЯ
ПО АЭРОНАВТИКЕ И ИССЛЕДОВАНИЮ КОСМИЧЕСКОГО ПРОСТРАНСТВА:
МЕЖДУНАРОДНЫЕ ПЕРСПЕКТИВЫ

Исследование в СССР. Начальный этап

Изучение распространения научных знаний и информации
по авиации и космонавтике / NASA. Этап 4.



1. Насколько важен в Вашей работе обмен научно-технической информацией (например, публикации или устные дискуссии) ?

совсем не важен 1 2 3 4 5 очень важен

2. Сколько примерно часов в неделю за последние 6 месяцев Вы уделяли обмену научно-технической информацией (НТИ) ?

..... часов в неделю на подготовку публикаций.
..... часов в неделю на научные дискуссии.

3. Как Вы считаете, изменилось ли за последние 5 лет время, затрачиваемое Вами на обмен НТИ ? (Отметьте подходящий ответ.)

1. Увеличилось.
2. Не изменилось.
3. Уменьшилось.

4. Сколько примерно часов в неделю за последние 6 месяцев Вы уделяли работе с НТИ, полученной от ДРУГИХ ?

..... часов в неделю на чтение публикаций
..... часов в неделю на научные дискуссии.

5. Как изменилось в связи с Вашим профессиональным ростом время, которое Вы уделяете работе с НТИ, получаемой от ДРУГИХ ? (Отметьте подходящий ответ.)

1. Увеличилось.
2. Осталось таким же.
3. Уменьшилось.

6. Какой процент Ваших публикаций составляют:

1. Публикации без соавторов .....% Если 100%, то перейдите к вопросу 9.
2. Публикации с одним соавтором .....%
3. Публикации с 2-5 соавторами .....%
4. Публикации с более чем 5-ю соавторами.....%

7. Какая форма работы (с соавторами или без) является, по Вашему мнению, более эффективной, т.е. производящей печатной продукции больше и/или лучшего качества? (Обведите кружком подходящий ответ.)

1. С соавторами.
2. Примерно одинаково.
3. Без соавторов.

8. Оставался ли постоянным в течение последних шести месяцев состав группы Ваших соавторов? (Отметьте подходящий ответ).

1. Да. Численный состав группы ..... человек.
2. Нет. С каким числом групп Вы сотрудничали? ..... количество групп.
Численный состав каждой группы приблизительно ..... человек.

9. Сколько (приблизительно) различных материалов НТИ из перечисленных ниже Вы подготовили за последние шесть месяцев?

	Без соавторов	С соавторами	Число соавторов
1. Аннотации, рефераты	.....	.....	.....
2. Статьи для научных журналов	.....	.....	.....
3. Материалы конференций, симпозиумов	.....	.....	.....
4. Промышленные каталоги	.....	.....	.....
5. Чертежи, спецификации	.....	.....	.....
6. Аудио/видео материалы	.....	.....	.....
7. Письма	.....	.....	.....
8. Докладные записки	.....	.....	.....
9. Технические предложения	.....	.....	.....
10. Технические руководства	.....	.....	.....
11. Документация к компьютерным программам	.....	.....	.....
12. Внутренние технические отчёты	.....	.....	.....
13. Доклады и сообщения на семинарах	.....	.....	.....
14. Заявки на изобретения	.....	.....	.....

10. Сколько (приблизительно) различных материалов НТИ из перечисленных ниже Вы использовали за последние шесть месяцев?

	Число раз за последние 6 месяцев
1. Аннотации, рефераты	.....
2. Статьи в научных журналах	.....
3. Материалы съездов, конференций, симпозиумов	.....
4. Промышленные каталоги	.....
5. Чертежи, спецификации	.....
6. Аудио/видео материалы	.....
7. Письма	.....
8. Докладные записки	.....
9. Технические предложения, условия	.....
10. Технические руководства	.....
11. Документация к компьютерным программам	.....
12. Внутренние технические отчеты	.....
13. Доклады на научных семинарах	.....

11. Какие виды НТИ Вы используете в Вашей настоящей работе? (Обведите кружком соответствующий ответ)

	Да	Нет
1. Научно-техническая информация общего характера	1	2
2. Описания техники эксперимента	1	2
3. Стандарты и нормативные документы	1	2
4. Методики и методы проектирования	1	2
5. Компьютерные программы	1	2
6. Внутренние технические отчеты	1	2
7. Технические и рабочие характеристики	1	2
8. Технико-экономическая информация	1	2
9. Технические условия и спецификации	1	2
10. Патенты, изобретения	1	2

12. Какую НТИ Вы производите (или предполагаете создавать) в Вашей настоящей работе? (Обведите кружком соответствующий ответ)

	Да	Нет
1. Научно-техническая информация общего характера	1	2
2. Техника и методика эксперимента	1	2
3. Стандарты и нормативные документы	1	2
4. Методики и методы проектирования	1	2
5. Компьютерные программы	1	2
6. Внутренние технические отчеты	1	2
7. Технические и рабочие характеристики	1	2
8. Технические условия и спецификации	1	2
9. Патенты, изобретения	1	2

13. Когда Вы пишете или подготавливаете к публикации НТИ, пользуетесь ли Вы помощью: (Обведите кружком соответствующий ответ)

	Всегда	Обычно	Иногда	Никогда
1. Своих коллег	1	2	3	4
2. Технических редакторов или референтов	1	2	3	4
3. Оформителей	1	2	3	4

14. Какой из приведенных ниже ответов наилучшим образом отражает деятельность по оформлению Ваших научно-исследовательских работ (изготовлению рисунков, графиков и т.п.)? (Обведите кружком ТОЛЬКО ОДИН ответ)

1. Всё оформление я делаю сам от руки.
2. Всё оформление я делаю с помощью компьютера.
3. Эту работу выполняют оформители.
4. Иногда оформлением я занимаюсь сам, иногда передаю эту работу оформителям.
5. Оформительскую работу выполняет секретарь.
6. Оформление выполняется иным способом.

15. Изучали ли Вы когда-либо курсы, включающие методы использования НТИ и подготовку НТИ к публикации? (Обведите кружком подходящий ответ.)

1. Да, во время учёбы в ВУЗе.
2. Да, после окончания ВУЗа.
3. Да, и в ВУЗе, и после его окончания.
4. Нет. В случае такого ответа, перейдите к вопросу 17.

16. Насколько полезными оказались приобретенные знания в работе с НТИ?

1. Существенно.
2. Мало.
3. Бесполезными.

17. Считаете ли Вы необходимым курс по вопросам НТИ при подготовке специалистов в области авиационно-космической науки и техники в ВУЗе ? (Обведите кружком подходящий ответ.)

1. Да.
2. Нет.
3. Не имею определенного мнения.

(Если Вы выбрали ответ 2 или 3, перейдите к вопросу 24).

18. Какой, по Вашему мнению, должна быть форма отчетности при изучении этого курса? (Обведите подходящий ответ).

1. Должен быть курс со сдачей зачёта
2. Должен быть курс без сдачи зачёта
3. Не имею определенного мнения.

19. Считаете ли Вы, что курс по вопросам НТИ должен быть: (Обведите подходящий ответ)

1. Частью обязательного курса
2. Частью курса по выбору
3. Самостоятельным курсом
4. Не имею определенного мнения

Если Вы выбрали ответ 1,2, или 4, перейдите к вопросу 21.

20. Считаете ли Вы, что отдельный курс по вопросам НТИ должен быть (Обведите подходящий ответ)

1. Обязательным курсом
2. Курсом по выбору
3. Не имею определенного мнения

21. Какие из приведенных ниже разделов следовало бы включить в курс по вопросам НТИ при подготовке специалистов в области авиационно-космической науки и техники в ВУЗе ? (Обведите кружком подходящий ответ.)

	Да	Нет
1. Определение целей НТИ	1	2
2. Оценка информационных потребностей исследователя	1	2
3. Организация системы НТИ	1	2
4. Разработка структуры публикации (введение, переходы и выводы)	1	2
5. Стиль и форма научных публикаций	1	2
6. Цитирование и ссылки	1	2
7. Редактирование и внесение исправлений	1	2
8. Терминология (избегание многословия и т.д.)	1	2
9. Ведение дискуссий	1	2
10. Другое (укажите)		

22. Что из приведенного ниже следовало бы включить в курс по вопросам НТИ, при подготовке специалистов в области авиационной науки и техники в ВУЗе ? (Обведите кружком подходящий ответ.)

	Да	Нет
1. Использование сокращений	1	2
2. Использование акронимов	1	2
3. Использование заглавных букв	1	2
4. Использование чисел	1	2
5. Использование знаков пунктуации	1	2
6. Использование ссылок и справочников	1	2
7. Правописание	1	2
8. Использование специальных символов	1	2
9. Соотношения между различными системами измерений	1	2
10. Другое (укажите)		

23. Каким профессиональным навыкам, из приведенных ниже, необходимо обучать студентов во время курса по вопросам НТИ при подготовке специалистов в области авиационной науки и техники в ВУЗе? (Обведите кружком подходящие ответы.)

	Да	Нет
1. Аннотирование и реферирование	1	2
2. Ведение деловой переписки	1	2
3. Написание докладных записок	1	2
4. Написание технических инструкций	1	2
5. Написание и оформление статей для научных журналов	1	2
6. Подготовка к докладам на конференциях	1	2
7. Умение писать обзоры	1	2
8. Умение писать технические руководства	1	2
9. Написание заметок в информационные бюллетени и рекламные проспекты	1	2
10. Умение делать устные научно-технические сообщения	1	2
11. Умение работать с техническими спецификациями	1	2
12. Умение писать и оформлять научно-технические отчёты	1	2
13. Использование источников НТИ	1	2
14. Другое (укажите)		

24. Используете ли Вы компьютер при составлении и оформлении НТИ ? (Обведите подходящий ответ.)

1. Всегда.
2. Как правило.
3. Иногда.
4. Никогда. (Перейдите к вопросу 27)

25. Увеличило ли использование компьютера Ваши возможности обмена НТИ ? (Обведите подходящий ответ.)

1. Существенно увеличило.
2. Немного увеличило.
3. Совсем не увеличило.

26. Используете ли Вы какие-либо из приведенных ниже компьютерных программ при написании и оформлении НТИ ? (Обведите кружком подходящие ответы.)

	Да	Нет
1. Текстовый редактор	1	2
2. Программа оформления	1	2
3. Программа проверки грамматики и стиля	1	2
4. Программа проверки орфографии	1	2
5. Компьютерные словари и справочники	1	2
6. Программа деловой графики	1	2
7. Программа научной графики	1	2
8. Настольная издательская система	1	2

27. Как Вам представляется использование Вами следующих видов электронно-информационных технологий при обмене НТИ ?

Информационные технологии	Я это уже использую	Я этим ещё не поль - зуюсь, но допускаю использова-ние в буду щем	Я это не использую и сомнева-юсь в том, что буду	Не имею представления
1. Звукозаписи на магнитных лентах и кассетах	1	2	3	4
2. Кинофильмы	1	2	3	4
3. Видеокассеты	1	2	3	4
4. Настольная издательская система	1	2	3	4
5. Компьютерные кассеты, дискеты	1	2	3	4
6. Электронная почта	1	2	3	4
7. Электронные бюллетени	1	2	3	4
8. ФАКС и ТЕЛЕКС	1	2	3	4
9. Электронные базы данных	1	2	3	4
10. Видеозаписи конференций	1	2	3	4
11. Телетрансляции конференций	1	2	3	4
12. Микрофиши и микроформы	1	2	3	4
13. Лазерные звуковые и видеодиски, лазерные диски для компьютеров	1	2	3	4
14. Электронно-информационные сети	1	2	3	4
15. Электронно-информационные локальные сети	1	2	3	4

28. Когда Вы сталкиваетесь с технической проблемой, какой из приведенных ниже способов её решения Вы избираете? (Обведите кружками подходящие ответы.)

	Да	Нет
1. Обсуждение проблемы с коллегами	1	2
2. Обсуждение проблемы с Вашим непосредственным руководителем	1	2
3. Обсуждение с экспертами из Вашей организации	1	2
4. Обсуждение с экспертами из сторонних организаций.	1	2
5. Обращаетесь к внутренним техническим отчётам	1	2
6. Используете библиотечные источники (например, материалы конференций, совещаний, научно-технические журналы, монографии, руководства и справочники)	1	2
7. Используете информационно-технические источники, такие как: компьютеризованные базы данных; систематизированные и реферативные указатели информации; компактные диски с нанесённой на них информацией и современные средства защиты компьютерных программ	1	2
8. Обращаетесь за помощью в библиотеки и к специалистам в области НТИ	1	2
9. Используете персональные справочно-информационные фонды, включая источники информации, комплектуемые в Вашей организации	1	2

29. Существует ли библиотека или отдел НТИ в Вашей организации? (Обведите кружком подходящий ответ.)

1. Да, в том же здании, где я работаю.
2. Да, но территориально это не близко.
3. Нет. (Перейдите к вопросу 33)

30. Как далеко от места Вашей работы расположены библиотека или отдел НТИ Вашей организации ?

..... километров

31. Насколько важно для Вас в Вашей работе наличие библиотеки или отдела НТИ в Вашей организации ? (Обведите оценку.)

Совсем не важно 1 2 3 4 5 Очень важно

32. Сколько примерно раз за последние полгода Вы обращались в библиотеку или отдел НТИ Вашей организации ?

..... раз.

Следующие сведения будут использованы для определения специфики того, как участвуют в обмене и потреблении НТИ специалисты с различными личностными данными

33. Ваш пол:

1. Мужской 2. Женский

34. Ваше образование:

1 Среднее
2 Среднее специальное по специальности . . . .
3 Высшее по специальности . . . .
4 Кандидат или доктор . . . . наук
5 Другое (Укажите) . . . .

35. Ваш стаж работы в области авиационно-космической науки и техники: ..... лет.

36. Какое из приведенных ниже определений наилучшим образом отражает Вашу основную профессиональную деятельность? (Обведите только один номер.)

01 Исследовательская
02 Преподавательская (включая исследовательскую)
03 Проектно-конструкторская
04 Промышленно-производственная
05 Техническое обслуживание оборудования
06 Маркетинг. Сбыт продукции
07 Административно-управленческая
08 Консультативная
09 Другое (укажите) . . . .

37. Вами было получено следующее профессиональное образование: (Отметьте)

1 Инженерно-техническое
2 Университетское
3 Другое (укажите) . . . .

38. В Вашей настоящей работе Вы считаете себя прежде всего: (Отметьте)

1 Инженером
2 Научным сотрудником, исследователем
3 Другое (укажите) . . . .

39. Являетесь ли Вы членом каких-либо профессиональных (инженерных, научных или технических) обществ? (Отметьте)

1. Да 2. Нет

ДОПОЛНИТЕЛЬНЫЕ ВОПРОСЫ.

1. Хотите ли Вы что-либо ещё добавить о возможностях обмена научно-технической информацией между специалистами в области авиационно-космической науки и техники?

2. Что ещё может быть сделано для улучшения обмена научно-технической информацией в области авиационно-космической науки и техники?

3. Сколь важными для Вас являются публикации в специальной литературе в период Вашего профессионального роста и становления? (Отметьте)

Совершенно не важны 1 2 3 4 5 Очень важны.

4. Каково отношение Вашего руководства к Вашим публикациям в профессиональной литературе ? (Отметьте)

Совсем не поддерживает 1 2 3 4 5 Очень поддерживает.

APPENDIX D

U.S. SURVEY INSTRUMENT

Technical Communications in Aerospace: An International Perspective

An Exploratory Study Conducted at the NASA Langley Research Center

Phase 4 of the Aerospace Knowledge Diffusion Research Project

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1. In your work, how important is it for you to communicate (e.g., producing written materials or oral discussions) technical information effectively? (Circle number)

   Very Unimportant 1 2 3 4 5 Very Important

2. In the past 6 months, about how many hours did you spend each week communicating technical information?

   (output) ____ hours per week writing

   ____ hours per week communicating orally

3. In the past 6 months, about how many hours did you spend each week working with technical information received from others?

   (input) ____ hours per week working with written information

   ____ hours per week receiving information orally

4. Compared to 5 years ago, how has the amount of time you have spent **communicating** technical information changed? (Circle number)

   1. Increased
   2. Stayed the same
   3. Decreased

5. As you have advanced professionally, how has the amount of time you have spent working with technical information **received from others** changed? (Circle number)

   1. Increased
   2. Stayed the same
   3. Decreased

6. What percentage of your written technical communications involve:

Writing alone	__%	⟶ (If 100% alone, skip to question 9.)
Writing with one other person	__%	
Writing with a group of 2 to 5 persons	__%	
Writing with a group of more than 5 persons	__%	
	100%	

7. In general, do you find writing as part of a group more or less productive (i.e., quantity/quality) than writing alone? (Circle number)

   1. A group is less productive than writing alone
   2. A group is about as productive as writing alone
   3. A groups is more productive than writing alone
   4. Difficult to judge; no experience preparing technical information

8. In the past 6 months, did you work with the same group of people when producing written technical communications? (Circle number)

   1. Yes ⟶ About how many people were in the group: _____number of people

   2. No ⟶ With about how many groups did you work: _____number of groups

      ↓

      About how many people were in each group: _____number of people

9. Approximately how many times in the past 6 months did you write or prepare the following alone or in a group? (If in a group, how many people were in each group?)

	Times in Past 6 Months Produced		
	Alone	In a group	
a. Abstracts	___times	___times	___Average No. of people
b. Journal articles	___	___	___
c. Conference/Meeting papers	___	___	___
d. Trade/Promotional literature	___	___	___
e. Drawings/Specifications	___	___	___
f. Audio/Visual materials	___	___	___
g. Letters	___	___	___
h. Memoranda	___	___	___
i. Technical proposals	___	___	___
j. Technical manuals	___	___	___
k. Computer program documentation	___	___	___
l. AGARD technical reports	___	___	___
m. U.S. Government technical reports	___	___	___
n. In-house technical reports	___	___	___
o. Technical talks/Presentations	___	___	___

10. Approximately how many times in the past 6 months did you **use** the following?

a. Abstracts	__Times used in 6 months
b. Journal articles	__
c. Conference/Meeting papers	__
d. Trade/Promotional literature	__
e. Drawings/Specifications	__
f. Audio/Visual materials	__
g. Letters	__
h. Memoranda	__
i. Technical proposals	__
j. Technical manuals	__
k. Computer program documentation	__
l. AGARD technical reports	__
m. U.S. Government technical reports	__
n. In-house technical reports	__
o. Technical talks/Presentations	__

11. What types of technical information do you *USE* in your present job? (Circle appropriate numbers)

	Yes	No
Basic scientific and technical information	1	2
Experimental techniques	1	2
Codes of standards and practices	1	2
Computer programs	1	2
Government rules and regulations	1	2
In-house technical data	1	2
Product and performance characteristics	1	2
Economic information	1	2
Technical specifications	1	2
Patents	1	2

12. What types of technical information do you *PRODUCE* (or expect to produce) in your present job? (Circle appropriate number)

	Yes	No
Basic scientific and technical information	1	2
Experimental techniques	1	2
Codes of standards and practices	1	2
Computer programs	1	2
Government rules and regulations	1	2
In-house technical data	1	2
Product and performance characteristics	1	2
Economic information	1	2
Technical specifications	1	2
Patents	1	2

15. Have you ever taken a course in technical communications/writing? (Circle the appropriate number)

1. Yes, as an undergraduate →
2. Yes, after graduation
3. Yes, both
4. Presently taking
5. No

↓

16. How much did this course help you to communicate technical information? (Circle the appropriate number)

↓

1. A lot
2. A little
3. Not at all

17. Do you think that undergraduate aerospace engineering and science students should take a course in technical communications? (Circle the appropriate number)

1. Yes
2. No
3. Don't know

If you answered "no" or "don't know" to Question 17, please skip to Question 21. If you answered "yes" to Question 17, please continue to Question 18.

18. Do you think a technical communications course for undergraduate aerospace engineering and science students should be: (Circle the appropriate number)

1. Taken for credit
2. Not taken for credit
3. Don't know

If you answered "not taken" or "don't know" to Question 18, please skip to Question 21. If you answered "taken" to Question 18, please answer Question 19.

19. Do you think the technical communications course should be: (Circle the appropriate number)

1. Taken as part of a required course
2. Taken as part of an elective course
3. Don't know

If you think the technical communications course should be taken as a separate course, please answer Question 20. Otherwise, please skip to Question 21.

20. Do you think the technical communications course should be: (Circle the appropriate number)

1. Taken as part of an engineering course
2. Taken as a separate course
3. Taken as part of another course
4. Don't know

21. Which of the following **principles** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

	Yes	No
Defining the purpose of the communication	1	2
Assessing the needs of the reader	1	2
Organizing information	1	2
Developing paragraphs (introductions, transitions, and conclusions)	1	2
Writing sentences	1	2
Notetaking and quoting	1	2
Editing and revising	1	2
Choosing words (avoiding wordiness, jargon, slang, sexist terms)	1	2
Other (specify) ______________		

22. Which of the following **mechanics** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

	Yes	No
Abbreviations	1	2
Acronyms	1	2
Capitalization	1	2
Numbers	1	2
Punctuation	1	2
References	1	2
Spelling	1	2
Symbols	1	2
Other (specify) ______________		

23. Which of the following on-the-job skills should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

	Yes	No
Abstracts	1	2
Letters	1	2
Memoranda	1	2
Technical instructions	1	2
Journal articles	1	2
Conference/Meeting papers	1	2
Literature reviews	1	2
Technical manuals	1	2
Newsletter/newspaper articles	1	2
Oral (technical) presentations	1	2
Technical specifications	1	2
Technical reports	1	2
Use of information sources	1	2
Other (specify) ________________		

24. Do you use computer technology to prepare technical information? (Circle the appropriate number)

1. Always
2. Usually
3. Sometimes
4. Never

If you answered "never" to Question 24, please skip to Question 27, otherwise, please answer Question 25.

25. How much computer technology increased your ability to communicate technical information? (Circle the appropriate number)

1. Yes, a lot
2. Yes, a little
3. No, not really
4. No, not at all

26. Do you use any of the following software to prepare written technical information? (Circle the appropriate numbers)

	Yes	No
Word processing	1	2
Outliners and prompters	1	2
Grammar and style checkers	1	2
Spelling checkers	1	2
Thesaurus	1	2
Business graphics	1	2
Scientific graphics	1	2
Desktop publishing	1	2

27. How do you view your use of the following electronic/information technologies in communicating technical information? (Circle the appropriate number)

Information Technologies	I already use it	I don't use it, but may in the future	I don't use it and doubt if I will
Audio tapes and cassettes	1	2	3
Motion picture film	1	2	3
Video tape	1	2	3
Desk top/electronic publishing	1	2	3
Computer cassette/cartridge tapes	1	2	3
Electronic Mail	1	2	3
Electronic bulletin boards	1	2	3
FAX or TELEX	1	2	3
Electronic data bases	1	2	3
Video conferencing	1	2	3
Teleconferencing	1	2	3
Micrographics & microforms	1	2	3
Laser disc/video disc/CD-ROM	1	2	3
Electronic networks	1	2	3

28. At your work place, do you use electronic networks in performing your present duties?

1. Yes
2. No
3. No because I do not have access to electronic networks

If you answered "no" to Question 28, please skip to Question 34. If you answered "yes" to Question 28, please continue to Question 29.

29. At your work place, how do you access electronic networks?

1. By using a mainframe terminal
2. By using a personal computer
3. By using a workstation

30. How important is the use of electronic networks to performing your present duties?

Very Unimportant 1 2 3 4 5 Very Important

31. Based on a 40-hour work week, what percentage of your time do you use electronic networks?

______Percentage of the past work week

32. Do you use electronic networks for the following purposes?

	Yes	No
1. To connect to geographically distant sites	1	2
2. For electronic mail	1	2
3. For electronic bulletin boards or conferences	1	2
4. For electronic file transfer	1	2
5. To log into remote computers for such things as computational analysis or to use design tools	1	2
6. To control remote equipment such as laboratory instruments or machine tools	1	2
7. To access/search the library's catalogue	1	2
8. To order documents from the library	1	2
9. To search electronic data bases (e.g., RECON)	1	2
10. For information search and data retrieval	1	2
11. To prepare scientific and technical papers which colleagues at geographically distant sites	1	2

33. Do you exchange electronic messages or files with:

	Yes	No
1. Members of your work group	1	2
2. Other people in your organization (at the same geographic site) who are not in your work group	1	2
3. Other people in your organization (at a geographically different site) who are not in your work group	1	2
4. People outside of your organization	1	2

34. How likely would you be to use the following information if it was available in electronic format?

	Very Unlikely				Very Likely
1. Data tables/mathematical presentations	1	2	3	4	5
2. Computer program listings	1	2	3	4	5
3. Online system (with full text and graphics) for NASA technical papers	1	2	3	4	5
4. CD-ROM system (with full text and graphics) for NASA technical reports	1	2	3	4	5

35. Which of the following best explains why you would not be using these materials in electronic format?

1. No/limited computer access
2. Hardware/software incompatibility
3. Prefer printed format
4. Other (specify) ______________________________

36. Does your organization have a library/technical information center? (Circle the appropriate number)

1. Yes, in my building
2. Yes, but not in my building ⟶ ___Miles
3. No

If you answered "yes" to Question 36, please continue to Question 37. If you answered "no" to Question 36, please skip to Question 39.

37. In the past six months, about how often did you use your organization's library/technical information center?

_____Number of times in past 6 months

38. In terms of performing your present professional duties, how important is your organization's library/technical information center? (Circle the appropriate number)

Not at all important 1 2 3 4 5 Very important

39. When faced with solving a technical problem, which of the following sources do you usually consult?

Please sequence these items (e.g., #1, #2, #3, #4, #5) or put an X beside the steps you did not use.

Sequence

_____Used my personal store of technical information, including sources I keep in my office

_____Spoke with co-workers or people inside by organization

_____Spoke with colleagues outside my organization

_____Spoke with a librarian or technical information specialist

_____Used literature resources (e.g., conference papers, journals, technical reports) found in my organization's library)

(If you used none of the above steps, check here____.)

These data will be used to determine whether people with different backgrounds have different technical communication practices.

40. Sex:

1. Female
2. Male

41. Education:

1. No degree
2. Bachelors
3. Masters
4. Doctorate
5. Other (specify) __________

42 Years of professional aerospace work experience:

___years

43. Type of organization where you work: (Circle ONLY ONE number)

1. Academic
2. Industrial
3. Not-for-profit
4. Government
5. Other (specify) __________

44. Which of the following BEST describes your primary professional duties? (Circle ONLY ONE number)

01 Research
02 Administration/Mgt
03 Design/Development
04 Teaching/Academic (may include research)
05 Manufacturing/Production
06 Private consultant
07 Service/Maintenance
08 Marketing/Sales
09 Other (specify) __________

45. Was your academic preparation as an:

1. Engineer
2. Scientist
3. Other (specify) ________

46. In your present job, do you consider yourself primarily an:

1. Engineer
2. Scientist
3. Other (specify) ________

47. Are you a member of a professional (national) engineering, scientific, or technical society?

1. Yes
2. No

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13. ABSTRACT *(Maximum 200 words)*

As part of Phase 4 of the *NASA/DoD Aerospace Knowledge Diffusion Research Project*, two studies were conducted that investigated the technical communications practices of Russian and U.S. aerospace engineers and scientists. Both studies have the same five objectives: first, to solicit the opinions of aerospace engineers and scientists regarding the importance of technical communications to their profession; second, to determine the use and production of technical communications by aerospace engineers and scientists; third, to seek their views about the appropriate content of an undergraduate course in technical communications; fourth, to determine aerospace engineers' and scientists' use of libraries, technical information centers, and on-line data bases; and fifth, to determine the use and importance of computer and information technology to them. A self-administered questionnaire was distributed to aerospace engineers and scientists at the Central Aero-Hydrodynamic Institute (TsAGI), and NASA Ames Research Center, and the NASA Langley Research Center. The completion rates for the Russian and U.S. surveys were 64 and 61 percent, respectively. Responses of the Russian and U.S. participants to selected questions are presented in this report.

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